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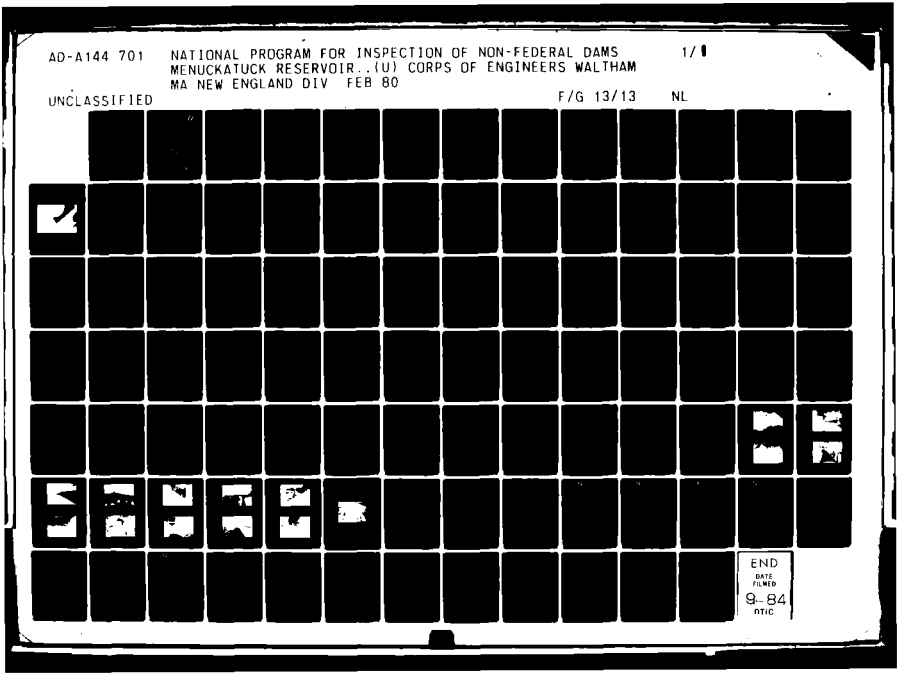
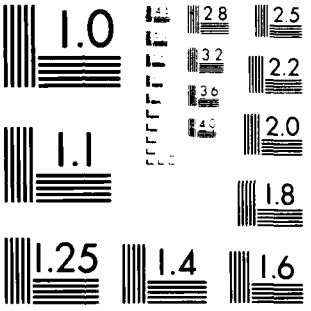
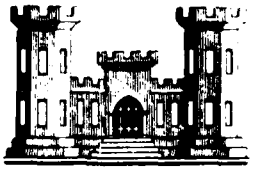




CONNECTICUT CENTRAL COASTAL AREA
GUILFORD , CONNECTICUT

MENUCKATUCK RESERVOIR DAM
CT-00408

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEER
WALTHAM , MASS. 02154

FEBRUARY 1980

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

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Connecticut Central Coastal Area
Guilford, Connecticut

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Menuckatuck Reservoir Dam is a concrete gravity structure with a downstream earth embankment. The total length of the dam is 248 feet. The reservoir has a storage volume of 653 acre-feet and the size classification based on the height is thus intermediate. The dam has been classified as having a high hazard potential. The dam is judged to be in generally good condition. For the combination of dam size (intermediate) and downstream hazard (high), the magnitude of the spillway test flood is required to be the PMF.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF
NEDED-E

JUN 30 1980

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

Inclosed is a copy of the Menuckatuck Reservoir Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. The report is based upon a visual inspection, a review of past performance, and a preliminary hydrological analysis. A brief assessment is included at the beginning of the report.

The preliminary hydrologic analysis has indicated that the spillway capacity for the Menuckatuck Reservoir Dam would likely be exceeded by floods greater than 23 percent of the Probable Maximum Flood (PMF), the test flood for spillway adequacy. Our screening criteria specifies that a dam of this class which does not have sufficient spillway capacity to discharge fifty percent of the PMF, should be adjudged as having a seriously inadequate spillway and the dam assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The term "unsafe" applied to a dam because of an inadequate spillway does not indicate the same degree of emergency as that term would if applied because of structural deficiency. It does indicate, however, that a severe storm may cause overtopping and possible failure of the dam, with significant damage and potential loss of life downstream.

It is recommended that within twelve months from the date of this report the owner of the dam engage the services of a professional or consulting engineer to determine by more sophisticated methods and procedures the magnitude of the spillway deficiency. Based on this determination, appropriate remedial mitigating measures should be designed and completed within 24 months of this date of notification. In the interim a detailed emergency operation plan and warning system should be promptly developed. During periods of unusually heavy precipitation, round-the-clock surveillance should be provided.

NEDED-E
Honorable Ella T. Grasso

I have approved the report and support the findings and recommendations described in Section 7, with qualifications as noted above. I request that you keep me informed of the actions taken to implement these recommendations since this follow-up is an important part of the non-Federal Dam Inspection Program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. This report has also been furnished to the owner of the project, the New Haven Water Company, New Haven, Connecticut.

Copies of this report will be made available to the public, upon request to this office, under the Freedom of Information Act, thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for the cooperation extended in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

MENUCKATUCK RESERVOIR DAM

CT 00408

CONNECTICUT CENTRAL COSTAL AREA

GUILFORD, CONNECTICUT

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	CT 00408
Name of Dam:	Menuckatuck Reservoir Dam
Town:	Guilford
County and State:	New Haven, Connecticut
Stream:	Branch Brook
Date of Inspection:	31 October, 1979

BRIEF ASSESSMENT

Menuckatuck Reservoir Dam is a concrete gravity structure with a downstream earth embankment. The total length of the dam is 248 feet with a maximum height of 58 feet. A 42 foot wide concrete gravity spillway section is located at the right side of the dam. Concrete steps on the downstream face transmit flow to a concrete spillway raceway 300 feet long that discharges to a bedrock channel. The outlet works consist of an intake gatehouse for drawing off water to the supply system and a 36 inch diameter cast iron pipe that serves as the low level outlet.

Menuckatuck Reservoir is used as a potable water supply source. The reservoir has a storage volume of 653 acre-feet and the size classification based on the height is thus intermediate. A breach of the dam could effect several homes in addition to flooding Connecticut Route 77. With the potential possibility for the loss of more than a few lives and the probability of serious economic losses, the dam has been classified as having a high hazard potential.

The dam is judged to be in generally good condition. The concrete surfaces were recently gunited and are in good condition. The horizontal and vertical alignment is good. The downstream earth embankment is well-maintained and did not show any evidence of sloughing or seepage. Slight erosion of the embankment was noted adjacent to the concrete at both abutments. A few small trees have been planted along the crest of the downstream embankment. The concrete spillway weir and spillway raceway are in good condition with minor seepage at construction joints on the floor of the spillway raceway.

For the combination of dam size (intermediate) and downstream hazard (high), the magnitude of the spillway test flood is required to be the PMF. The spillway test flood inflow is 7235 CFS. The maximum spillway capacity is 1644 CFS at a stage of 5 feet above the spillway crest (equal to the top of dam). The capacity

of the spillway is inadequate to pass the full PMF test flood outflow (7030 CFS) without overtopping the dam. The test flood would overtop the dam by about 3.1 feet. The spillway is adequate to pass about 23 percent of the spillway test flood outflow. Because of the spillway inadequacy the project is rated at "FAIR".

Within one year of receipt of the Phase I Inspection Report, the owner should retain a qualified registered engineer to conduct more refined hydrologic and hydraulic analysis to determine the need for and methods of increasing the project discharge capacity.

Within one year of receipt of the Phase I Inspection Report, the owner should carry out the following operating and maintenance procedures: 1) remove small trees growing on the downstream slope and fill in holes with appropriate soils; 2) fill in animal burrows with suitable soils and grass over area; 3) institute a program of annual inspections of the dam and its appurtenant works by a qualified registered engineer; and 4) develop a formal surveillance plan for use during and immediately after heavy rainfall and also a warning program to follow in the event of emergency conditions.

S. Giavara, P.E.
President

Registered CT. 7634

This Phase I Inspection Report on Menuckatuck Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.

Joseph W. Finegan

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, CHAIRMAN
Chief, Structural Section
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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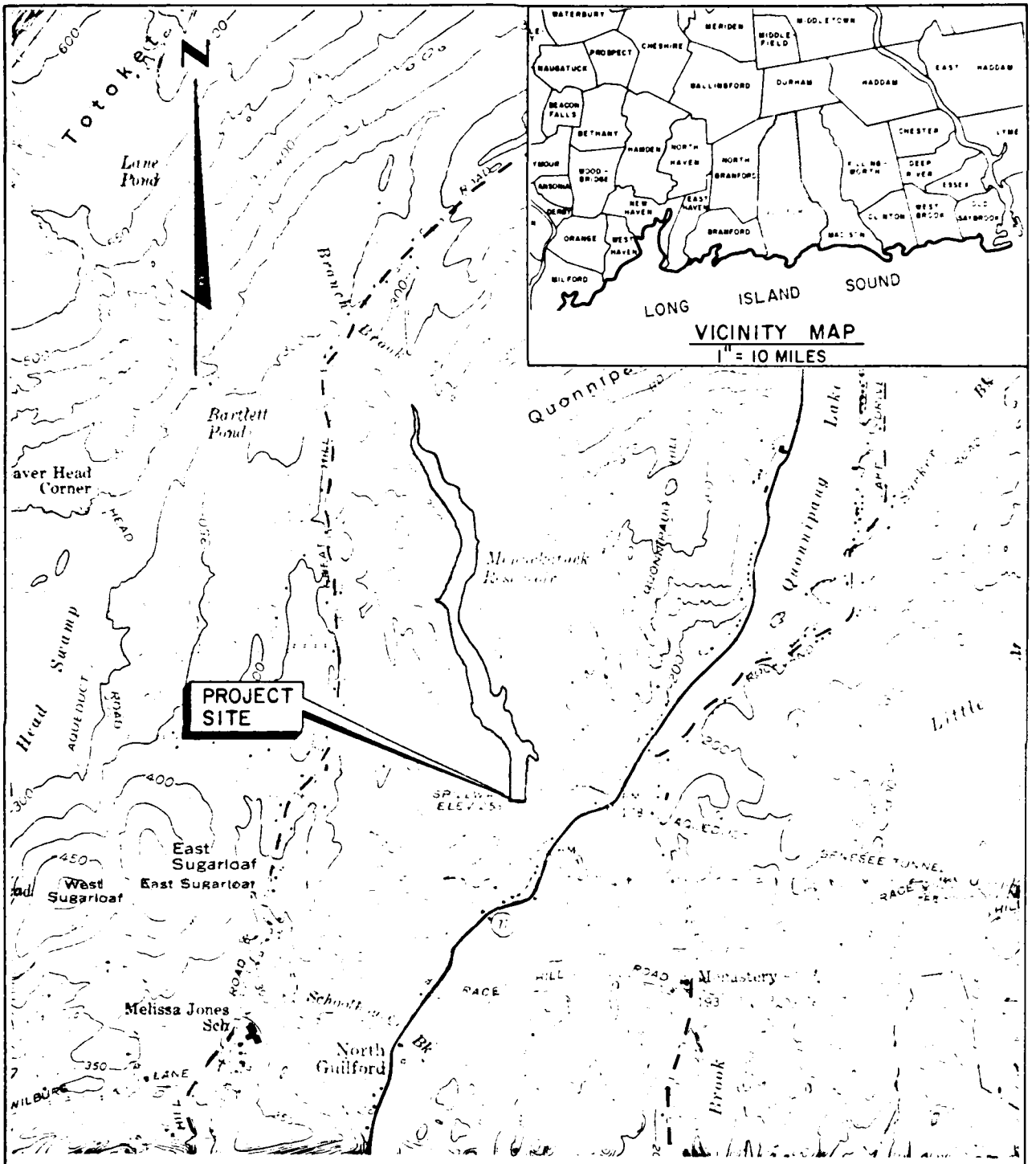
APPENDIXES



MENUCKATUCK RESERVOIR DAM

LOCATION MAP

GUILFORD , CONNECTICUT

FLAHERTY • GIAVARA ASSOCIATES, P.C.

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
MENUCKATUCK RESERVOIR DAM - CT 00408

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL:

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection through the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Flaherty Giavara Associates, P.C. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to Flaherty Giavara Associates, P.C. under a letter of 19 October 1979 from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-80-C-0001 has been assigned by the Corps of Engineers for this work.

b. Purpose.

1) Perform technical inspection and evaluation of non-federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.

2) Encourage and assist the States to initiate quickly effective dam safety programs for non-federal dams.

3) To update, verify and complete the National Inventory of Dams.

1.2 DESCRIPTION OF PROJECT:

a. Location. The Menuckatuck Reservoir Dam is located in Guilford, Connecticut on Branch Brook, a tributary stream of the West River. The reservoir is located approximately 1 mile north of the village of North Guilford. The reservoir is shown on the U.S.G.S. Topographic Map "Durham, Connecticut" at a latitude of 41°22'40" and a longitude of 72°42'48". The Location Map on page vi shows the location of the structure.

b. Description of Dam and Appurtenances. Menuckatuck Reservoir is a concrete gravity dam with a downstream earth embankment. The total length of the dam is 248 feet with a maximum height of 58 feet. The spillway is located at the right

abutment and is 42 feet in width. The crest of the dam is 9 feet in width at the crest elevation of 225 increasing to 40 feet in width at the base elevation of 194 feet. The upstream and downstream face of the concrete gravity structure are 0.05 horizontal to 1 vertical and 0.65 horizontal to 1 vertical respectively. The crest elevation of the downstream earth embankment is 215 with a width of 65 feet. The downstream embankment slope is grassed and slopes at 2.5 horizontal to 1 vertical.

The spillway consists of a concrete gravity section with a vertical upstream face and a sloping stepped downstream face. The elevation of the spillway is 250. Concrete training walls are located to each side of the spillway. Below the spillway is a concrete chute channel 300 feet in length. This channel varies in size and slope from 18 feet wide, 4 feet high, and 3 percent slope to 12 feet wide, 4 feet high, and 25 percent slope. At the base of the spillway channel water is discharged to a bedrock lined basin.

The outlet works consist of an intake gatehouse and a 36-inch diameter cast iron pipe that serves as the low level outlet. This blow off pipe has an inlet invert elevation of 209.75 feet. Water can also be drawn into the Sugarloaf Tunnel to El. 220.0(±) by operating a control gate in the intake gatehouse.

Located at the left abutment integral with the concrete gravity section is the tunnel gatehouse. This gatehouse operates the Quonnipaug Siphon from Lake Hammonasett and the Sugarloaf Tunnel, both of which join at this location. This conduit passing longitudinally through the concrete gravity section of the dam is 6, feet, 8 inches in diameter. Sluicegates within the gatehouse regulate the flow within the conduit.

c. Size Classification. Menuckatuck Reservoir Dam has a storage volume of 653 acre-feet and a dam height of 58 feet. A dam height of greater than 40 feet and less than 100 feet classifies this structure in the "intermediate" category according to guidelines established by the Corps of Engineers.

d. Hazard Classification. The dam is classified as having a "high" hazard potential. The areas of probable impact are largely agricultural with approximately 6 residential dwellings. In addition, Connecticut Route 77 is located 1000± feet downstream of the dam. With the potential for the loss of more than a few lives and the probability of serious economic losses, the dam has been classified as having a high hazard potential.

e. Ownership. The Menuckatuck Reservoir Dam is owned by the New Haven Water Company, 90 Sargent Drive, New Haven, Connecticut 06511.

f. Operator. The person responsible for the operation of the dam is Mr. Jack Reynolds, New Haven Water Company, telephone: (203) 624-6671.

g. Purpose of Dam. The reservoir is used as a potable water supply source by the New Haven Water Co.

h. Design and Construction History. The dam was designed by Albert B. Hill and constructed by C.W. Blakeslee and Sons, Inc. in 1928-1929. In 1947 gunite repairs were designed by Clarence Blair Associates, Inc. and constructed by Cement Gun Co. In addition, the dam has recently been resurfaced with a layer of concrete.

i. Normal Operations Procedures. Normal operating procedure at the reservoir is to draw water through the intake structure and associated conduit to the water supply tunnel. Excess water is wasted over the spillway section.

1.3 PERTINENT DATA:

a. Drainage Area. The drainage area consists of 3.71 square miles of wooded upland terrain. The watershed is rural with sparse residential development. It is moderate to steeply sloping and bounded by Totoket Mountain to the northwest. Lane Pond and Bartlett Pond are located in the upstream watershed. Lane Pond has two outlets, one feeding Wallingford's Pistapaug Reservoir.

b. Discharge at the Dam Site.

1) A 36-inch diameter cast iron pipe (invert elevation 209.75) extends from the intake gatehouse to the toe of the downstream embankment. The outlet capacity has been computed to be 223 CFS based on a water level equal to the spillway crest.

2) There are no known records of past floods or flood stage heights at the dam.

3) The ungated spillway capacity at the top of dam - 1644 CFS @ El. 255.0.

4) The ungated spillway capacity at the test flood elevation - 2492 CFS @ El. 256.6.

5) The gated spillway capacity at normal pool elevation is not applicable at this dam.

6) The gated spillway capacity at test flood elevation is not applicable at this dam.

7) The total spillway capacity at test flood elevation - 2492 @ El. 256.6.

8) The total project discharge at the top of dam - 1644 CFS @ El. 255.0.

9) The total project discharge at test flood elevation - 7030 CFS @ El. 258.1.

c. Elevation. (Ft. above National Geodetic Vertical Datum - NGVD)

1) Streambed at toe of dam.....197

2) Bottom of cut-off.....N/A

3) Maximum tailwater.....N/A

4) Recreation pool.....N/A

5) Full flood control pool.....N/A

6) Spillway crest.....250

7) Design surcharge (Original Design).....Unknown

8) Top of dam.....255

9) Test flood design surcharge.....256.6

d. Reservoir. (Length in feet)

1) Normal pool.....5700

2) Flood control pool.....N/A

3) Spillway crest pool.....5700

4) Top of dam.....6300

5) Test flood pool.....6350

e. Storage. (acre-feet)

1) Normal pool.....505

2) Flood control pool.....N/A

3) Spillway crest pool.....505

4) Top of dam.....653

5) Test flood pool.....700

f. Reservoir Surface. (acres)

1) Normal pool.....26.6

2) Flood-control pool.....N/A

3) Spillway crest.....26.6

4) Test flood pool.....35.0

5) Top of dam.....32.6

g. Dam.

1)	Type:	Concrete gravity with earth abutment.
2)	Length:	248 feet
3)	Height:	58 feet
4)	Top Width:	9 feet
5)	Side Slopes:	Upstream and downstream gravity wall: vertical. Downstream earth embankment: 2 horizontal to 1 vertical.
6)	Zoning:	N/A
7)	Impervious Core:	Concrete Core
8)	Cut-off:	See Below
9)	Grout Curtain:	Grout Holes Indicated on Plans

h. Diversion Tunnel.

1)	Type:	Conduit longitudinally through concrete dam - 6'8" diameter.
2)	Length:	Not applicable
3)	Closure:	Not applicable
4)	Access:	Tunnel Gatehouse
5)	Regulating Facilities:	Tunnel Gatehouse Sluicegates

i. Spillway.

1)	Type:	Concrete gravity with stepped downstream face.
2)	Length of weir:	42 feet
3)	Crest elevation:	250 feet
4)	Gates:	None
5)	U/S Channel:	Reservoir
6)	D/S Channel:	Concrete chute channel/ natural stream with bedrock and boulder bed.

j. Regulating Outlets.

1)	Invert:	209.75
2)	Size:	36" diameter
3)	Description:	Cast iron pipe
4)	Control Mechanism:	Manually operated gates located in gatehouse.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN:

Plans are available and contain the principal information regarding the dam and its appurtenances. The plans that were reviewed in the preparation of this report include:

a. Final plans of Menuckatuck Dam. New Haven Water Co. - North Branford Development, dated January 1930.

b. Tunnel gatehouse and spillway, Menuckatuck Dam. New Haven Water Co. - North Branford Development, dated May 1927.

c. Intake gatehouse and spillway, Menuckatuck Dam. New Haven Water Co. - North Branford Development, dated Mar. 1927.

d. Spillway channel, Menuckatuck Dam. New Haven Water Co. - North Branford Development, dated Oct. 1929.

e. Sluicegates at Menuckatuck Dam (plan of wall pipe for tunnel). New Haven Water Co., dated July 2, 1928.

f. Plan of weir at Menuckatuck Dam. New Haven Water Co., dated March 1930.

2.2 CONSTRUCTION:

No information was recovered regarding construction of the dam. Subsequent gunite repairs to the dam were carried out in 1947 and apparently again during the last few years.

2.3 OPERATION:

Operation of the dam is by the New Haven Water Company. No formal records of operation are maintained for this facility.

2.4 EVALUATION:

a. Availability. The information noted above for this facility is available in the files of the New Haven Water Company.

b. Adequacy. The lack of in-depth engineering data did not allow a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on the visual inspection, the dam's past performance, and sound engineering judgement.

c. Validity. Two-12" dia. outlet pipes were noted on each side of the 36" dia. blow off. These pipes are not shown on the construction plans. No other conflicts have been noted between the available data and the observations made during the inspection. In general, there is no reason to question the validity of the available data.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS:

a. General. Based on the visual inspection, Menuckatuck Reservoir Dam and its appurtenances are judged to be in good condition. The dam consists of a concrete gravity section with a downstream earth embankment. The concrete surface was recently gunited and is in good condition, with only minor deterioration and spalling noted. The horizontal and vertical alignment is good. The downstream earth embankment is well maintained and did not show any evidence of sloughing or seepage. Slight erosion of the embankment was noted adjacent to the concrete at both abutments. Numerous small trees have been planted along the crest of downstream embankment. The concrete spillway weir and spillway raceway are in good condition with minor seepage at construction joints on the floor of spillway raceway.

b. Dam. The dam has been very well tended, with evidence of a continued program of mowing and concrete maintenance and repair.

1) Upstream Face - The concrete face is in good condition as indicated in Photo No. 1 and Photo No. 2. Some spalling horizontally along the face at about the spillway elevation was noted (see Photo No. 3). Some efflorescence and discoloration of the concrete surface has occurred as indicated in Photo No. 3 and Photo No. 9 (apparently rust stains and high water marks). Generally the condition of the upstream face is good with no evidence of structural cracking or severe deterioration.

2) Crest - The crest is level and the concrete is in good condition. The vertical and horizontal alignment is good (Photo No. 4).

3) Downstream Face - The exposed concrete on the downstream face is in good condition. Small diameter pipes were seen protruding from the downstream face of the concrete wall as shown in Photo No. 5. The purpose of these pipes is not known.

4) Downstream Embankment - The earth embankment is in good condition showing no indications of deformation, sloughing or major erosion (Photo No. 6 and Photo No. 7). Some minor erosion has taken place along the right side of the embankment adjacent to the spillway wing wall. The downstream slope of the embankment was covered with grass vegetation which appears to be mowed regularly. Numerous small seedling trees have been planted along the crest of the embankment. A worn path has developed along the crest as a result of vehicular traffic.

Numerous animal holes up to 15 in. in diameter were located at locations in the grass cover on the downstream slope of the earth embankment. Other animal holes may exist which were not visually observed due to the grass cover.

5) Spillway - The spillway is coated with a new layer of gunite with complete coverage. The surface is in excellent condition. There are extensive areas of surface discoloration, apparently rust stains from the steel spillway service bridge. The spillway is shown in Photo No. 10 and Photo No. 11. The spillway raceway is in good condition. A tree had been uprooted and fell across the raceway as shown in Photo No. 12. At the end of the raceway a bridge provides truck access to the right abutment area. See Photo No. 13.

c. Appurtenant Structures. The outlet works consist of a gatehouse and a 36-inch diameter cast iron pipe that serves as the low level outlet (blow off). Two 12-inch diameter cast iron pipes were also noted at the end wall for the blow off as shown in Photo No.13.

The gatehouses were locked and could not be entered during the inspection. The gatehouses are well maintained and in good condition (Photo No. 13). The blow off pipes were inspected from the downstream end. One of the 12-in.-dia. pipes has experienced some corrosion at its outlet, and the other two pipes were found to be in good condition. Some water was noted flowing in the 36" dia. pipe.

The outlet pipes discharge onto the bedrock surface which forms the downstream channel bottom.

d. Reservoir Area. The perimeter of the reservoir is steep, portions of which are riprap protected, and not very high above the reservoir. There is no evidence of slides or slope failures. No sediment deposits were observed above the water level of the reservoir (see Photo No. 15).

e. Downstream Channel. The channel has a typical width of 20 to 30 feet and narrows to lesser widths along some sections. The channel bottom is in bedrock and covered with cobbles and boulders as indicated in Photo No. 14. The bedrock is a conglomerate and shows signs of slow degradation.

The sides of the downstream channel are very steep. The ravine through which the downstream channel flows consists of exposed bedrock and/or boulders mixed with wooded slopes.

f. Footbridge. The metal truss of the service bridge is in good condition. Only minor rusting has occurred. The wood planking on the bridge is in excellent condition (Photo No. 4 and Photo No. 11).

3.2 EVALUATION:

On the basis of the visual inspection, the dam is judged to be in good condition. The existence of small trees on the downstream berm and the numerous animal holes on the downstream could lead to future erosion problems.

SECTION 4 - OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 OPERATIONAL PROCEDURES:

a. General. The water level in the pond can be controlled by the low level 36" dia. blow off pipe. Water is withdrawn for supply through the upper gatehouse service gates, is transmitted to the lower gatehouse (tunnel gatehouse) where it enters the Sugarloaf Tunnel.

b. Description of any Warning System in Effect. There is no formal warning system in effect in the event of failure or partial failure of the structure.

4.2 MAINTENANCE PROCEDURES:

a. General. The dam and associated structures are generally very well maintained with a regular program of grass mowing and general maintenance in effect. Yearly routine inspections are carried out by New Haven Water Company staff. A consultant was hired to perform a cursory inspection of New Haven Water Company dams. Menuckatuck Reservoir Dam was inspected by the Water Company's consultant on October 26, 1979. No safety problems were noted in the inspection report (Appendix B).

b. Operating Facilities. The operating facilities are well maintained. A formal maintenance program, including valve exercising, is followed by the New Haven Water Company. The reservoir foreman maintains the Menuckatuck Reservoir, and ensures that the spillway is free of brush and debris.

4.3 EVALUATION:

The Menuckatuck Reservoir Dam, which is about 50 years old, is well operated and maintained. Although not designed for rapid drawdown, it should be noted that, if the need should arise, drawdown could be effected by allowing for maximum discharge through the 36-inch (El. 209.75) diameter blow off. Water can also be drawn into the Sugarloaf Tunnel to El. 220.0(±) by operating a control gate in the intake gatehouse. The blow off was not operated during the site inspection, therefore comments on the serviceability cannot be made. The valves, however, are tested on a periodic basis to ensure that they could be operated if required.

SECTION 5 - EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 GENERAL:

The Menuckatuck Reservoir Dam is a gravity concrete structure with a downstream earth embankment. The crest length of the dam is 248 feet; its height is 58 feet. The spillway is located near the right (west) abutment, and has a length of 42 feet.

The spillway discharges across concrete steps directly into a long rectangular concrete raceway that extends down the face of the dam adjacent to the right (west) abutment. The raceway has a moderate slope at the top and then increases to a 25 percent slope.

The watershed area is 3.7 square miles of upland terrain that is well wooded. The majority of the land within the watershed is presently undeveloped. Approximately 33 percent of the land within the watershed drains into ponds or lakes upstream of the Menuckatuck Reservoir Dam.

5.2 DESIGN DATA:

No specific design data is available for this watershed or the structures of Menuckatuck Reservoir Dam. In lieu of existing design information, U.S.G.S. Topographic Maps (scale 1" = 2000') were used to develop hydrologic parameters. Some of the pertinent hydraulic design data was obtained and/or confirmed by actual field measurements at the time of visual field inspection.

5.3 EXPERIENCE DATA: Historical data for recorded discharges is not available for this dam. Daily records of water surface elevations are maintained by the New Haven Water Company.

5.4 TEST FLOOD ANALYSIS:

The test flood for determining the spillway adequacy is based upon COE guidelines. The size classification of the dam is "intermediate" based upon a height of 58 feet and storage volume of 653 acre-feet. The hazard potential is "high" due to the land use downstream of the dam. The spillway test flood required by Corps of Engineers guidelines for this size dam and hazard potential is the probable maximum flood.

The spillway test flood selected for this project is the PMF, due to the potential for the loss of more than a few lives and the probability of appreciable economic loss due to dam failure.

The magnitude of the PMF is based upon "Preliminary Guidance for Estimating PMF Discharges" by the New England Division, Corps of Engineers, dated December, 1977. The watershed is rolling to steep, and has some floodwater storage areas in natural wetlands and impoundments. The flood magnitude was based on the "rolling" watershed curve. The PMF (spillway test flood) is 7235 CFS.

The maximum spillway capacity is 1644 CFS, without overtopping the dam (a stage of 5.0 above the spillway crest El. 255.0). The flow capacity of the concrete spillway raceway has been computed to be 2780 CFS for its upper (milder slope) portion and 4940 CFS for its lower (steeper slope) portion. The spillway raceway capacity is thus greater than that of the spillway, and does not reduce the flow over the spillway.

The spillway test flood was formed into a triangular hydrograph with a peak inflow of 7235 CFS and a duration of 11 hours. The duration was selected so that the triangular hydrograph would contain the same volume of water as the estimated storm runoff.

The hydrograph was routed through the reservoir using a computer program based on stage-storage and stage-discharge data. The reservoir was assumed to be full and level with the spillway prior to the storm event. The results of the flood routing computations indicate that the spillway test flood peak inflow rate of 7235 CFS is reduced to a peak outflow rate of 7030 CFS by the storage characteristics of the reservoir.

The peak flood stage from the test flood at the spillway is elevation 258.1, which is 3.1 feet above the crest of the dam. The duration of the overflow is estimated to be 9 hours. The spillway can pass 23 percent of the spillway test flood outflow (and 47 percent of the ½ PMF). It is not known whether the dam will fail if overtopped by the spillway test flood since the dam is a gravity concrete structure and may be stable without the downstream earth embankment.

5.5 DAM FAILURE ANALYSIS:

The downstream impact of a dam failure was analyzed using the COE "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs" dated April 1978.

Based upon an assumed breach width of 52 feet, which is equal to 40% of the dam's width at mid-height, the peak flood flow due to failure would be 38,590 CFS with an initial depth of

58 feet just downstream of the dam. The total flow (base flow plus failure outflow) is 40,240 CFS.

Using topography data from U.S.G.S. maps, the evaluation indicates that the dam failure floodwave would move rapidly down the steep valley of Menuckatuck Brook, and then spread out laterally on the broad West River floodplain.

The probable impact area is largely agricultural land on an existing floodplain. Connecticut State Route 77 runs along the west side of the floodplain, and would be subject to shallow flooding and accompanying economic loss. It is estimated that 6 one-family houses would be affected, 4 houses in the impact area would be flooded to a depth of 3 feet of water or less above existing ground level, and 2 houses would encounter about 5 feet of water above the ground level. With the potential for the loss of more than a few lives and the probability of serious economic losses, the dam has been classified as having a high hazard potential.

SECTION 6 - EVALUATION OF STRUCTURAL STABILITY

6.1 VISUAL OBSERVATIONS:

The visual inspection did not disclose any indications of structural instability.

6.2 DESIGN AND CONSTRUCTION DATA:

The design and construction data consisted of the construction drawings for the dam. No information is presented on the type of soil in the downstream earth embankment. There is insufficient design and construction data to permit a formal evaluation of stability. Thus the evaluation of stability is based solely on the visual inspection.

6.3 POST-CONSTRUCTION CHANGES:

There is no information available on post-construction changes. However, two 12-in.-dia. pipes were noted at the blow off end wall, and are not indicated on plans.

6.4 SEISMIC STABILITY:

The dam is located in Seismic Zone 1 and, in accordance with the recommended Phase I inspection guidelines, does not warrant seismic stability analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT:

a. Condition. On the basis of the visual inspection and review of available existing plans indicate that Menuckatuck Reservoir Dam is in good condition and functioning adequately. Existence of trees on the embankment and animal burrows could affect the long-term performance of the downstream embankment. The capacity of the spillway is inadequate to pass the PMF test flood outflow of 7030 CFS without overtopping the dam. The test flood would overtop the dam by about 3.1 feet. The spillway is adequate to pass about 23 percent of the spillway test flood outflow.

b. Adequacy of Information. The evaluation of the dam is primarily based on the visual inspection, assisted by the general physical dimensions provided in the available drawings.

c. Urgency. The owner should implement the recommendations and remedial measures presented in Sections 7.2 and 7.3 within one year after receipt of this Phase I Inspection Report.

7.2 RECOMMENDATIONS:

The owner should retain a qualified registered engineer to accomplish the following:

a. Conduct more refined hydrologic and hydraulic analysis to determine the need for and methods of increasing the project discharge capacity.

7.3 REMEDIAL MEASURES:

The owner should:

a. Remove small trees growing on the downstream slope and fill in holes with appropriate soils.

b. Fill in animal burrows with suitable soils and grass over area, as necessary.

c. Institute a program of annual technical inspections of the dam and its appurtenant works by a qualified registered engineer.

d. Develop a formal surveillance plan for use during and immediately after heavy rainfall and also a warning program to follow in the event of emergency conditions.

7.4 ALTERNATIVES:

There are no practical alternatives to the recommendations presented in Section 7.3 above.

APPENDIX A

INSPECTION CHECK LIST

INSPECTION CHECK LIST

PARTY ORGANIZATION

PROJECT Menuckatuck Reservoir Dam DATE Oct. 31, 1979

TIME 0900

WEATHER Sunny 60°F

W.S. ELEV.____ U.S.____ DN.S.

PARTY:

1. R. Smith, FGA, Project Manager
2. J. McBroom, FGA, Hydraulics/Hydrology
3. P. Burgess, FGA, Hydraulics/Hydrology
4. R. Murdock, GEI, Geotechnical
5.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Menuckatuck Reservoir Dam **DATE:** Oct. 31, 1979

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	None observed.
Pavement Condition	Grass.
Movement or Settlement of Crest	None.
Lateral Movement	None.
Vertical Alignment	Good.
Horizontal Alignment	Good.
Condition at Abutment and at Concrete Structures	Slight erosion adjacent to concrete at both abutments.
Indications of Movement of Structural Items on Slopes	None.
Trespassing on Slopes	Vehicular path over crest of embankment.
Sloughing or Erosion of Slopes or Abutments	Slight erosion on slope.
Rock Slope Protection - Riprap Failures	No riprap.
Unusual Movement or Cracking at or near Toes	None.
Unusual Embankment or Downstream Seepage	None.
Piping or Boils	None.
Foundation Drainage Features	None.
Toe Drains	None.
Instrumentation System	None.
Vegetation	Small trees planted along crest of downstream embankment.

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Menuckatuck Reservoir Dam DATE: Oct. 31, 1979

AREA EVALUATED	CONDITIONS
DIKE EMBANKMENT	Not applicable.
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	
Pavement Condition	
Movement or Settlement of Crest	
Lateral Movement	
Vertical Alignment	
Horizontal Alignment	
Condition at Abutment and at Concrete Structures	
Indications of Movement of Structural Items on Slopes	
Trespassing on Slopes	
Sloughing or Erosion of Slopes or Abutments	
Rock Slope Protection - Riprap Failures	
Unusual Movement or Cracking at or near Toes	
Unusual Embankment or Downstream Seepage	
Piping or Boils	
Foundation Drainage Features	
Toe Drains	
Instrumentation System	
Vegetation	

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Menuckatuck Reservoir Dam DATE: Oct. 31, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	Not applicable.
a. Approach Channel	
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Menuckatuck Reservoir Dam DATE: Oct. 31, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - CONTROL TOWER	Not applicable.
a. Concrete and Structural	
General Condition	
Condition of Joints	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	
Joint Alignment	
Unusual Seepage or Leaks in Gate Chamber	
Cracks	
Rusting or Corrosion of Steel	
b. Mechanical and Electrical	
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System in Gate Chamber	

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Menuckatuck Reservoir Dam DATE: Oct. 31, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - TRANSITION AND CONDUIT	Not applicable.
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Menuckatuck Reservoir Dam DATE: Oct. 31, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	Not applicable.
General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	
Channel	
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Menuckatuck Reservoir Dam DATE: Oct. 31, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	Underwater, face of dam.
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
b. Weir and Training Walls	
General Condition of Concrete	
Rust or Staining	
Spalling	
Any Visible Reinforcing	Little seepage at construction joints on floor of spillway raceway.
Any Seepage or Efflorescence	
Drain Holes	None.
c. Discharge Channel	
General Condition	Good, bedrock channel.
Loose Rock Overhanging Channel	Some loose rock on both sides of channel.
Trees Overhanging Channel	Trees on both sides of channel.
Floor of Channel	Bedrock.
Other Obstructions	Some brush and limbs noted.

PERIODIC INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Menuckatuck Reservoir Dam **DATE:** Oct. 31, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SERVICE BRIDGE	
a. Superstructure	Steel truss footbridge in generally good condition. No rust noted.
Bearings	Good condition.
Anchor Bolts	None missing.
Bridge Seat	Good condition.
Longitudinal Members	Good condition.
Under Side of Deck	Good condition.
Secondary Bracing	None observed.
Deck	Good Condition.
Drainage System	None observed.
Railings	Good condition.
Expansion Joints	None observed.
Paint	No chipping noted.
b. Abutment & Piers	
General Condition of Concrete	Overall condition of concrete is good.
Alignment of Abutment	Good.
Approach to Bridge	Good.
Condition of Seat and Backwall	Good.

APPENDIX B

ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Menuckatuck Res. Dam

I.D. NO. CT-00408

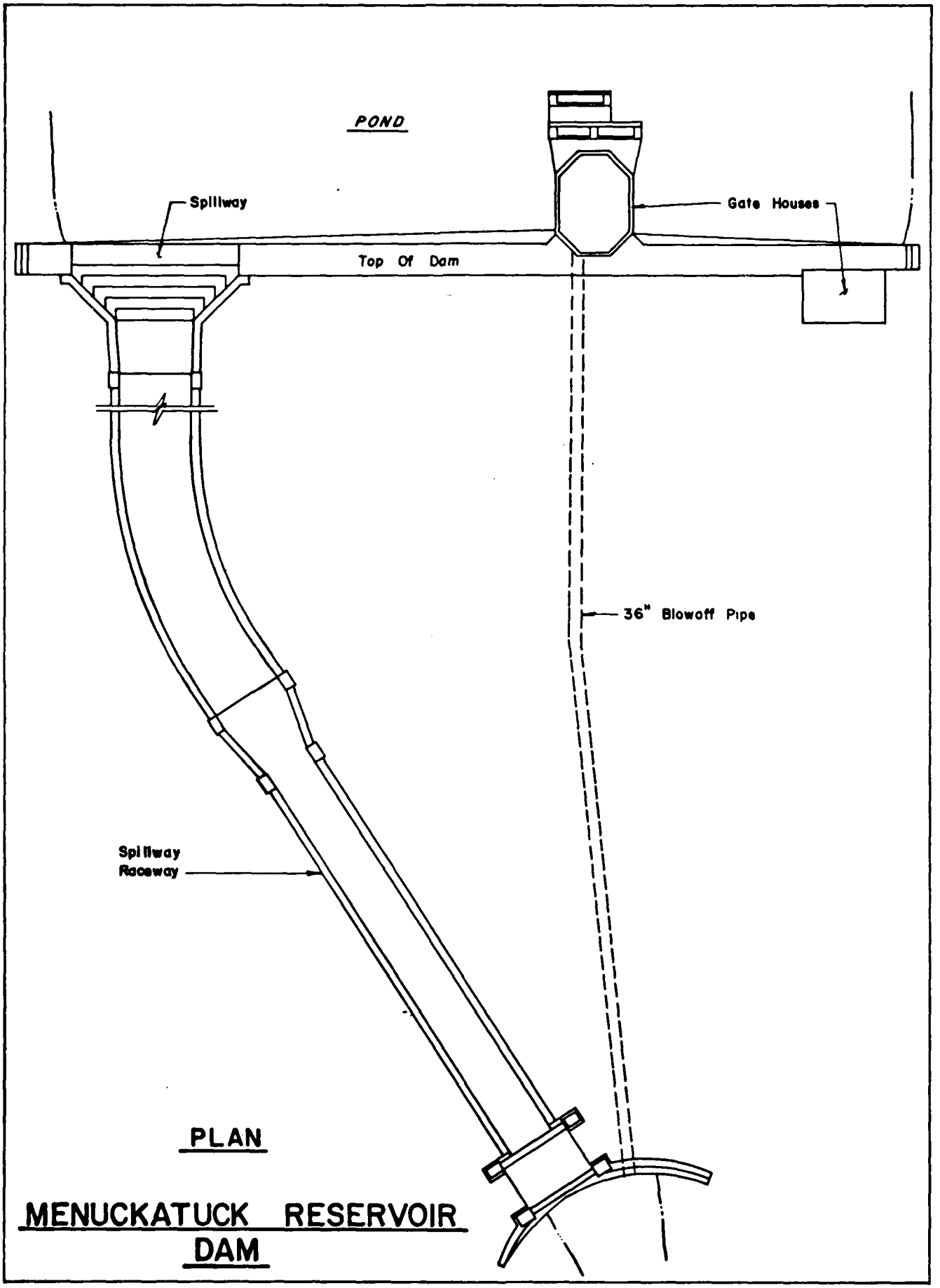
ITEM	REMARKS
AS-BUILT DRAWINGS	Construction Plans - New Haven Water Company Files
REGIONAL VICINITY MAP	Available from U.S.G.S.
CONSTRUCTION HISTORY	Limited Data - Water Co. Files
TYPICAL SECTIONS OF DAM	From plans
OUTLETS - Plan	From plans, field measurements
- Details	From plans
- Constraints	Unknown
- Discharge Ratings	None available
RAINFALL/RESERVOIR RECORDS	Unavailable
DESIGN REPORTS	None
GEOLOGY REPORTS	None
DESIGN COMPUTATIONS	
HYDROLOGY & HYDRAULICS	None
DAM STABILITY	None
SEEPAGE STUDIES	None
MATERIALS INVESTIGATIONS	
BORINGS RECORDS	None
LABORATORY	None
FIELD	None

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Menuckatuck Res. Dam

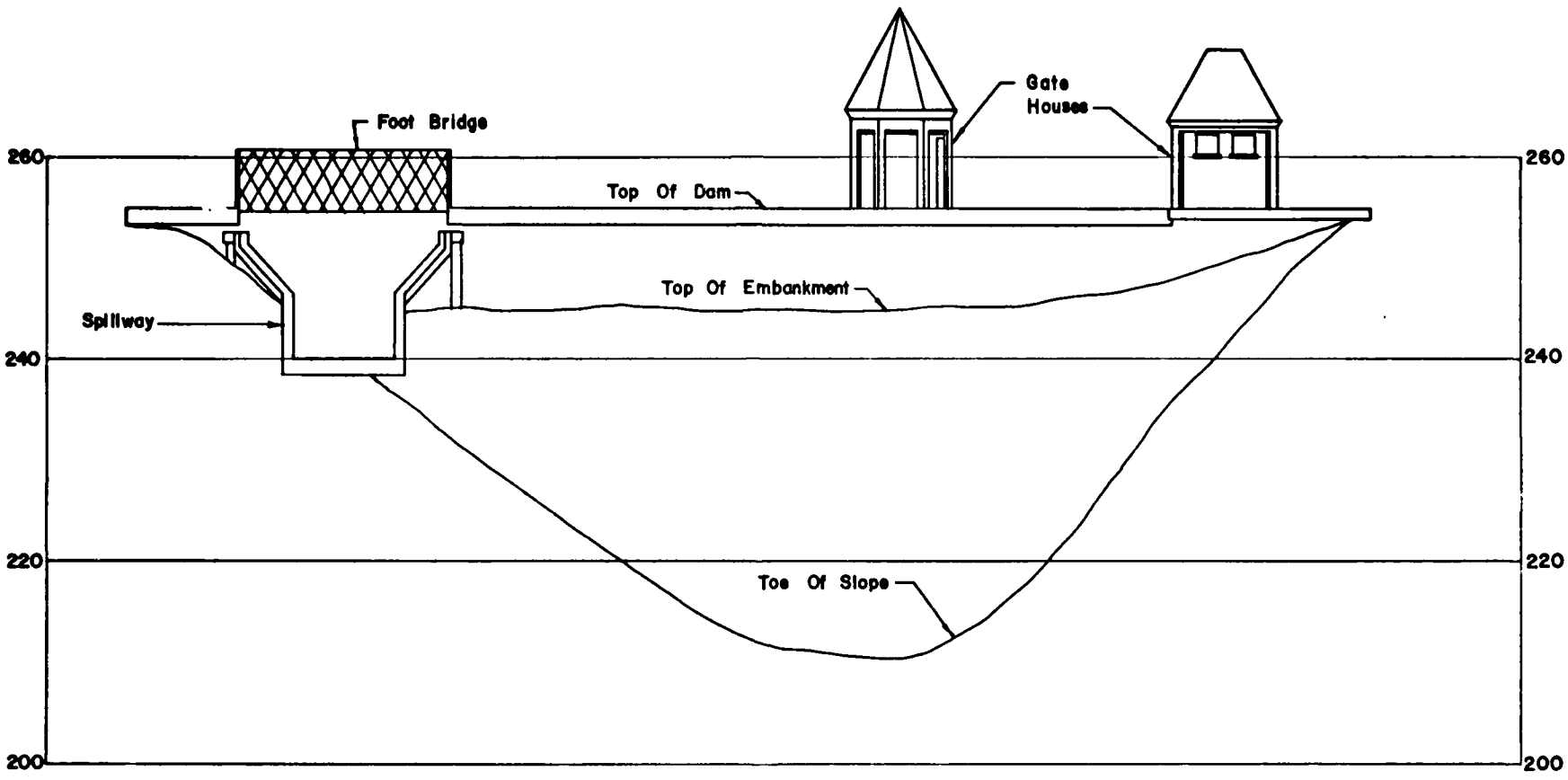
I.D. NO. CT-00408

ITEM	REMARKS
POST-CONSTRUCTION SURVEYS OF DAM	None available
BORROW SOURCES	Unknown
MONITORING SYSTEMS	Unknown
MODIFICATIONS	Unknown
HIGH POOL RECORDS	None
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Unknown
MAINTENANCE OPERATION RECORDS	Unavailable
SPILLWAY PLAN	
SECTIONS	From plans
DETAILS	From plans
OPERATING EQUIPMENT PLANS & DETAILS	From plans



PLAN

MENUCKATUCK RESERVOIR DAM



DOWNSTREAM ELEVATION OF DAM

MENUCKATUCK
RESERVOIR DAM

Inspection Date: October 26, 1979

Roald Haestad, Inc: Donald L. Smith
Ronald G. Litke

New Haven Water Co: Robert Geier

COMMENTS

LAKE MENUNKATUC

No seepage in the bottom of the channel this year. Sealant material is missing from some of the expansion joints. Water level is down 4 feet below spillway.

Debris from the resurfacing of the dam, including concrete and wire mesh, are piled below the dam.

Some minor spalling of the epoxy coating on the upstream face.

The wood planking on the foot bridge is in excellent condition.

No safety problems noted.

NEW HAVEN WATER COMPANY

STATISTICS ON DAMS*

NAME Menunkatuc

SUPPLY SYSTEM North Branford

LOCATION Guilford

DATES: ORIGINAL CONSTRUCTION 1928-1929

ADDITIONS, ALTERATIONS

	MEAN HIGH WATER ELEVATION	LENGTH
CREST**	255.0	248 Ft.
TOP OF CORE WALL		
SPILLWAY	250.0	42 Ft.
B. O. AXIS	210.5	320± Ft.
BED OF RIVER	209	
DEEPEST FOUNDATION	194	

FREEBOARD: CREST TO SPILLWAY 5.0 Ft.

CREST TO TOP OF CORE WALL

HEIGHT: CREST TO BED OF BROOK 46 Ft.

CREST TO DEEPEST FOUNDATION 61 Ft.

TYPE Concrete Gravity Section

TOP WIDTH--MAX. BOTTOM WIDTH (Ft.) 9 -- 40±

UPSTREAM SLOPE H/V 0.05/1.00

DOWNSTREAM SLOPE H/V 0.65/1.00

TRIBUTARY WATERSHED (Square Miles) 3.31

RESERVOIR AREA (Acres) 39.52

RESERVOIR TOTAL STORAGE (MG) 203.258

RESERVOIR USABLE STORAGE (MG) 197 (lowest outlet)

*See individual sheets for more details

**Crest Length includes spillway

Date 8/12/74

NEW HAVEN WATER COMPANY

NAME OF DAM Menunkatuc

TYPE Concrete, gravity-section with a stepped spillway on the west end. Soil and rock excavations for the dam, Sugar Loaf Tunnel and the Quonnipaug Tunnel placed on the downstream side of the dam, forming a downstream embankment about 65 feet wide at approximate elevation 245 MHW and sloping down therefrom on slope of approx. 2½ Hor. on 1 Ver.

LOCATION In the town of Guilford on West Branch Stream approximately 900 feet upstream from, and north of, the Guilford-Durham State Highway No. 77.

SUPPLY SYSTEM North Branford

DATE OF CONSTRUCTION

ORIGINAL 1928-1929

OTHER 1947 - Gunite repairs to dam, spillway and spillway channel concrete surfaces

ENGINEER

1928-29 Albert B. Hill
1947 Clarence Blair Assoc. Inc.

CONTRACTOR

C. W. Blakeslee & Sons, Inc.
Cement Gun Company

	Elevation	Length (Ft.)	Miscellaneous
CREST	255 MHW	248	Includes spillway
SPILLWAY	250 MHW	42	Stepped spillway
AXIS OF B. O.	210.5 MHW	±320	36" cast iron
BED OF RIVER	209 MHW	-	
DEEPEST FOUNDATION	194 MHW	-	

DATE August 1974

NEW HAVEN WATER COMPANY

Name of Dam Menunkatuc

HEIGHT FROM BED OF BROOK	46 Feet
HEIGHT FROM DEEPEST FOUNDATION	61 Feet
TOP WIDTH 8 feet plus 2 copings at 6" each =	9 Feet
MAXIMUM WIDTH AT BOTTOM	±40 Feet
UPSTREAM SLOPE	0.05 Hor. on 1.00 Ver
DOWNSTREAM SLOPE	0.65 Hor on 1.00 Ver
FREE BOARD - SPILLWAY TO CREST	5 Feet
- SPILLWAY TO TOP OF COREWALL	-

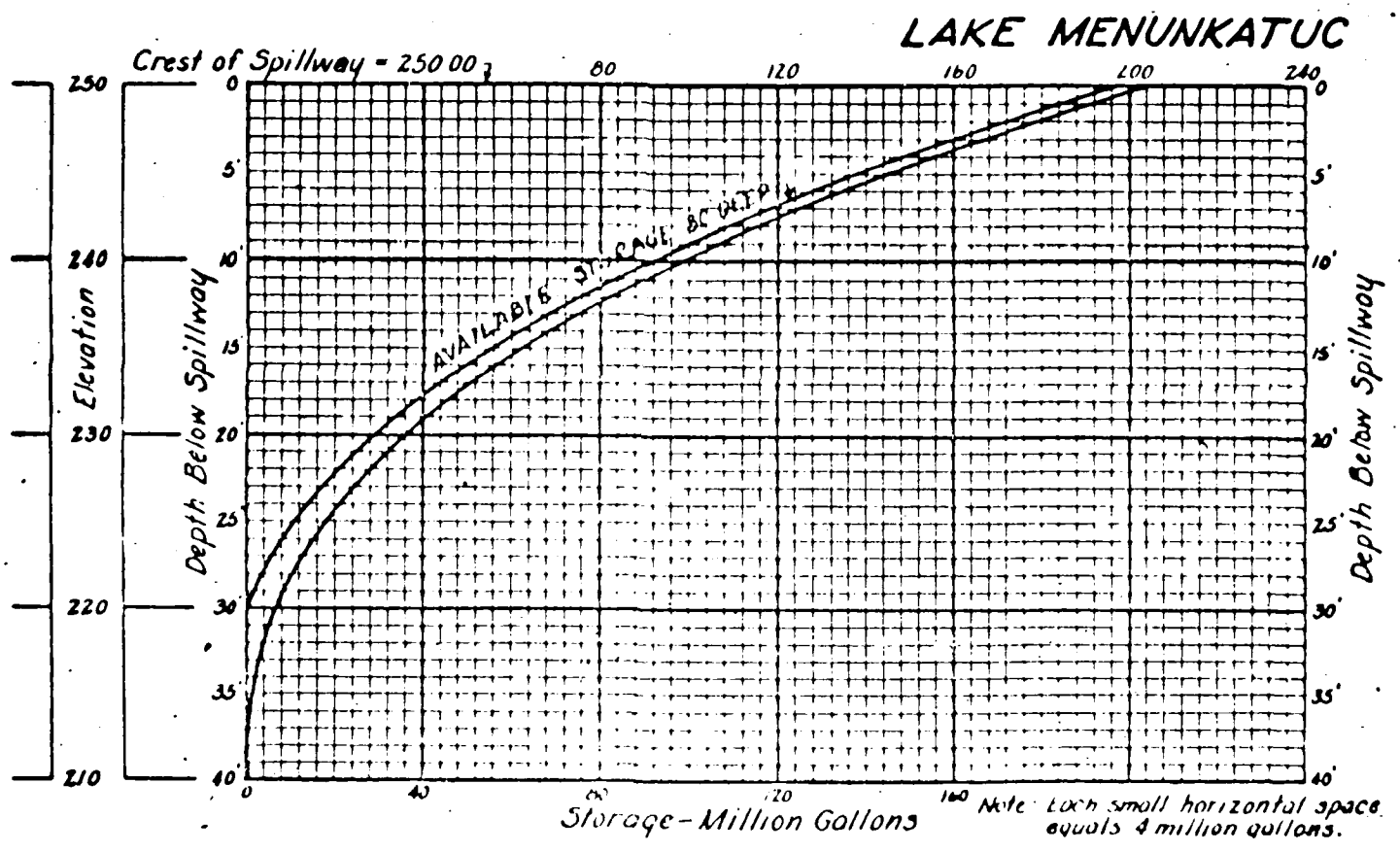
MISCELLANEOUS DATA A 24-inch future supply line was installed from the intake gatehouse through the dam and part way through the downstream embankment for a total length south from the intake gatehouse of approximately 60 feet.

WATERSHED TRIBUTARY TO:

UPSTREAM DAMS	Included in that tributary to Menunkatuc Dam
THIS DAM	3.31 Sq. Mi.
TOTAL WATERSHED TRIBUTARY TO THIS DAM	3.31 Sq. Mi.
RESERVOIR AREA AT FLOW LINE	39.52 Acres
RESERVOIR CAPACITY AT FLOW LINE	203.258 Mil. Gal.
RESERVOIR USABLE CAPACITY (To Lowest Outlet)	197 Mil. Gal.

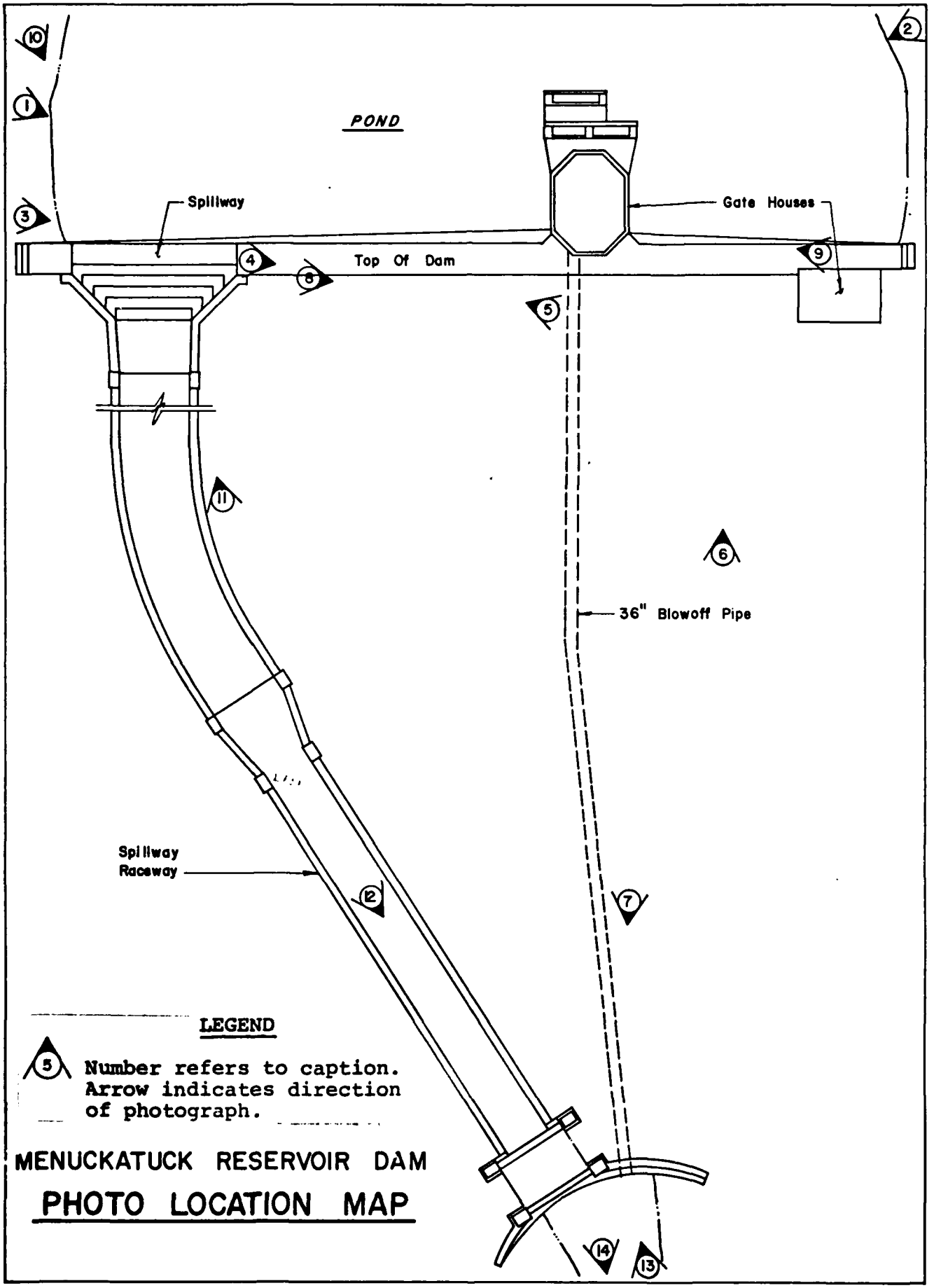
UPSTREAM DAMS Bartlett Pond Dam; Lane Pond Dam. (As this pond is part of the Wallingford water supply and used to replenish Wallingford's Pistapaug Reservoir, as needed, probably little runoff from Lane Pond flows southeast to Menunkatuc Reservoir.)

DOWNSTREAM DAMS Some small ponds; Thirsty Lake Pond Dam; Witch Hazel Pond Dam; Town Mill Pond Dam


LAKE MENUNKATUC
Crest of Spillway - 250.00
Elevation
Depth Below Spillway
AVAILABLE STORAGE
Storage - Million Gallons
Note: Each small horizontal space equals 4 million gallons.

APPENDIX C

PHOTOGRAPHS



MENUCKATUCK RESERVOIR DAM

PHOTO LOCATION MAP

PHOTO #1: Upstream face of dam from right (west) abutment.

PHOTO #2: Upstream face of dam from left (east) abutment.

PHOTO #3: Upstream face of dam looking towards left (east) abutment.

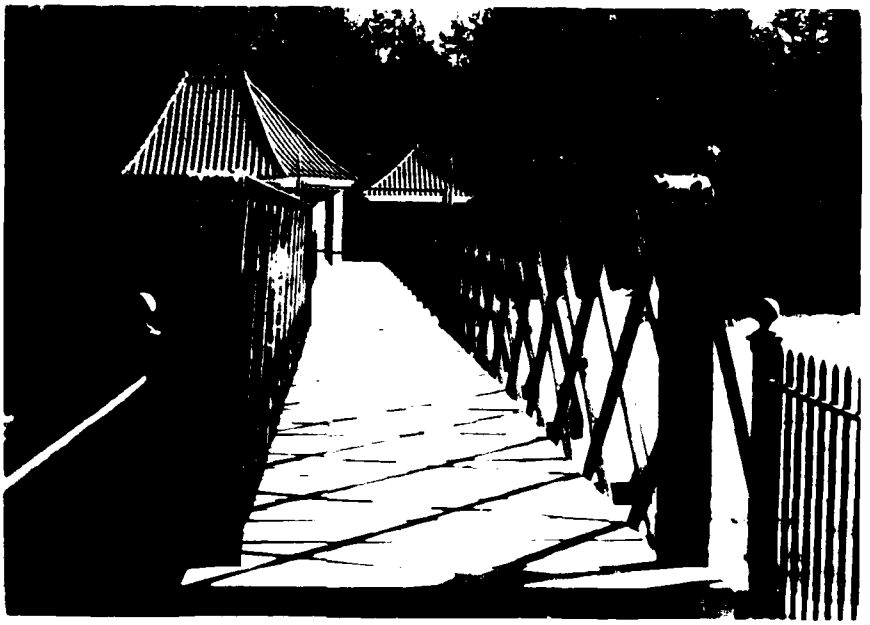


PHOTO #4: Crest of dam from right (west) abutment.

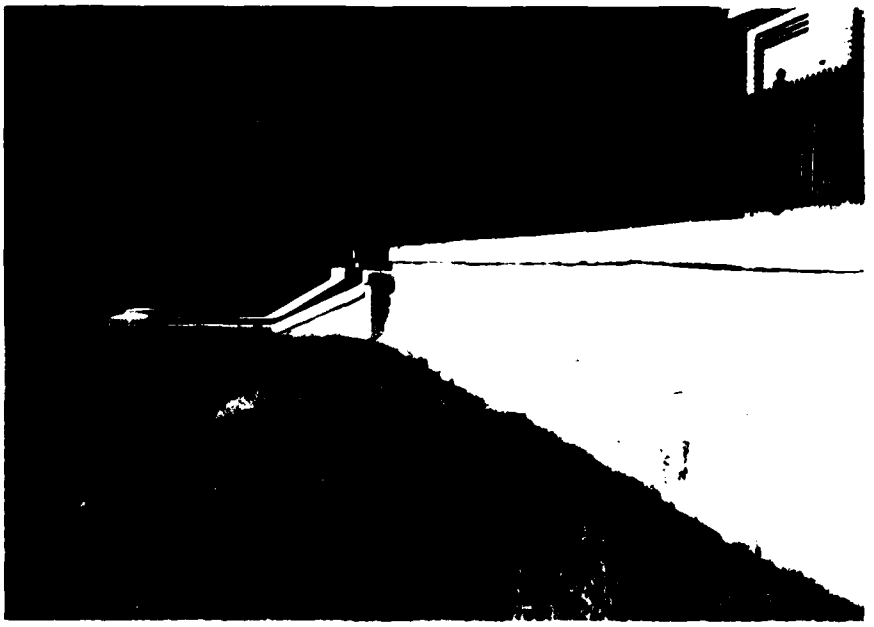


PHOTO #5: Downstream face and crest of downstream berm looking toward right (west) abutment.

PHOTO #6: Downstream slope from vicinity of toe.

PHOTO #7: Downstream slope.

PHOTO #8: Upstream face from right (west) abutment.

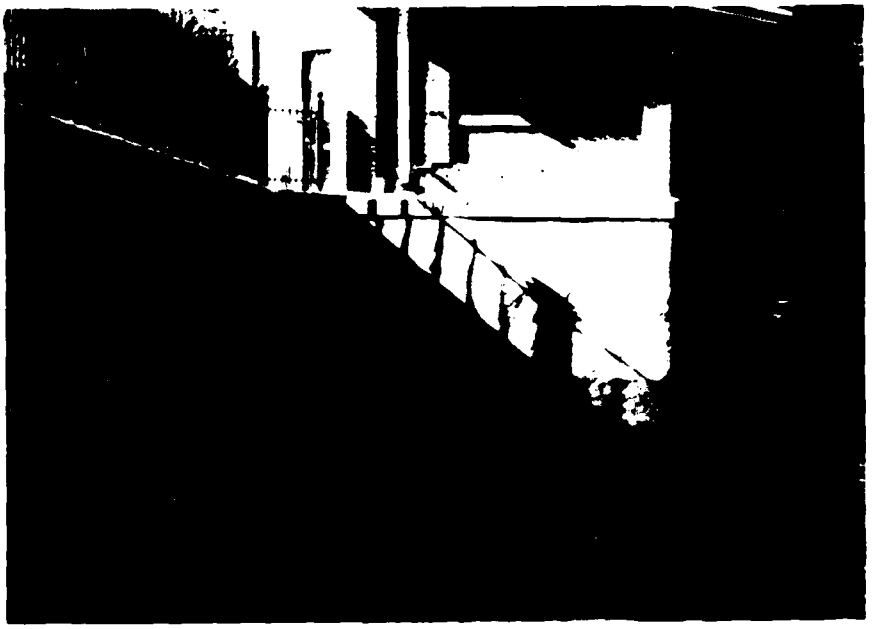


PHOTO #9: Gatehouse.

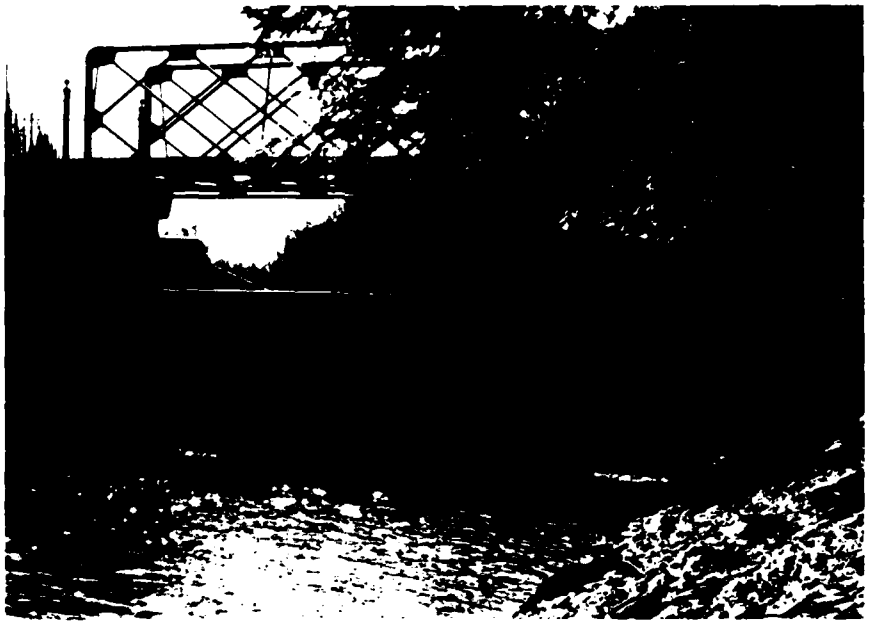


PHOTO #10: Approach to spillway weir.

PHOTO #11: Spillway and service bridge, looking upstream.

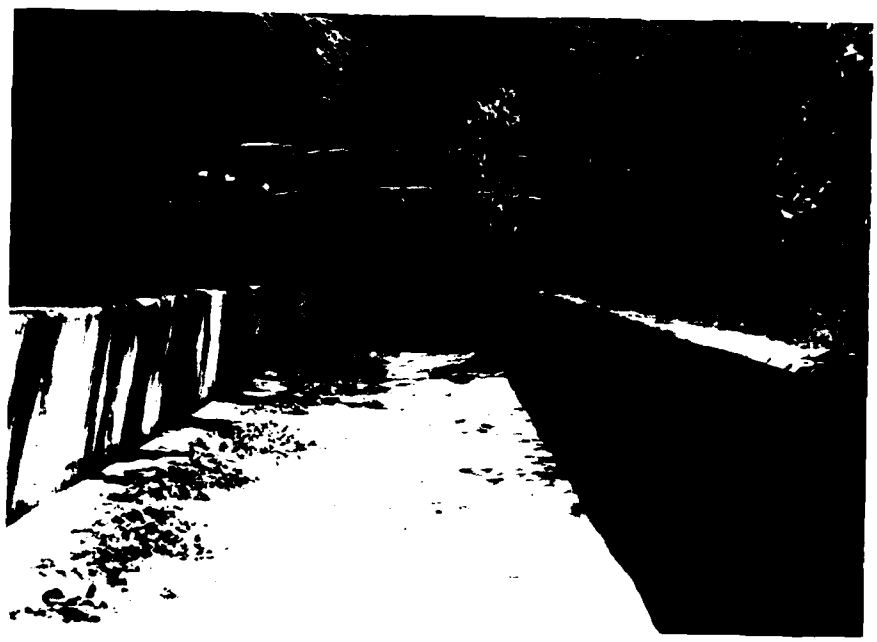


PHOTO #12: Spillway raceway.

PHOTO #13: 36" dia. and two 12" dia. blowoffs and bridge over spillway raceway.

PHOTO #14: Spillway channel.

APPENDIX D

HYDROLOGIC AND HYDRAULIC

COMPUTATIONS

DETERMINATION OF SPILLWAY TEST FLOOD*

A. SIZE CLASSIFICATION

Storage Volume (Ac.-Ft.) 653

Height of Dam (Ft.) 58

Size Classification INTERMEDIATE

B. HAZARD POTENTIAL CLASSIFICATION

Category	Loss of Life	Economic Loss
Low	None expected	Minimal
Significant	Few	Appreciable
High	More than few	Excessive

Hazard Classification SIGNIFICANT

C. HYDROLOGIC EVALUATION GUIDELINES

Hazard	Size	Spillway Test Flood
Low	Small	50 to 100-Year Frequency
	Intermediate	100-Year Frequency to 1/2 PMF
	Large	1/2 PMF to PMF
Significant	Small	100-Year Frequency to 1/2 PMF
	Intermediate	1/2 PMF to PMF
	Large	PMF
High	Small	1/2 PMF to PMF
	Intermediate	PMF
	Large	PMF

Spillway Test Flood PMF

*Based upon "Recommended Guidelines for Safety Inspection of Dams" Department of the Army, Office of the Chief of Engineers, November 1976.

CT 799010
TUCKAHOE REC.

FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN 06510/203/789-1260

SHEET NO. 2 OF
BY RAG DATE 1-15-90
CHK'D. BY JGM DATE 1-29-90

DETERMINATION OF THE

MAXIMUM PROBABLE FLOOD (MPF)

A. Drainage Area in Square Miles 3.71

B. Watershed Characteristic: Flat & Coastal

Rolling

Moutainous

C. M.P.F. in CFS/Square Mile,* 1950

M.P.F. = (CFS/Square Mile) x (Area in Square Miles)

1950 x 3.71 = 7235 CFS

*Based upon the figure "Maximum Probable Flood Peak Flow Rates" U.S. Army Corps of Engineers, December 1977.

FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN 06510/203/789-1260

THE PMP RAINFALL IS 24.0 INCHES FOR A 6 HOUR DURATION STORM. USING A 20% FACTOR FOR IMPERFECT FIT, THE EFFECTIVE RAINFALL IS 19.2 INCHES (SEE FIG 15, DESIGN OF SMALL DAMS).

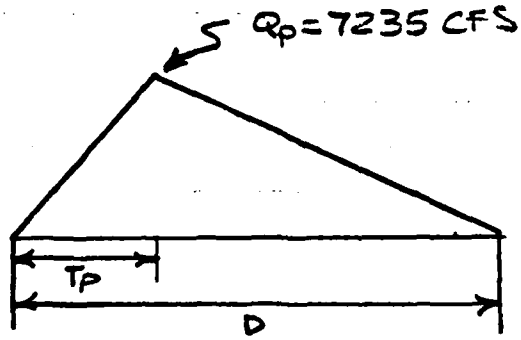
VOLUME OF RUNOFF

BASED ON AN ASSUMED CN VALUE OF 80 (FOR GLACIAL TILL SOILS), RUNOFF FOR THE PMP IS 16.5 INCHES (FIG A-4, DESIGN OF SMALL DAMS).

$$\left(\frac{16.5''}{12''/FT}\right)(3.71 ML^2)\left(640 \frac{AC}{ML^2}\right) = 3265 \text{ AC-FT}$$

TEST FLOOD HYDROGRAPH

A TRIANGULAR HYDROGRAPH IS TO BE USED FOR THE ROUTING OF THE TEST FLOOD THROUGH THE RESERVOIR, PEAK FLOW EQUALS 7235 CFS, SET DURATION OF RUNOFF SO AS TO CONTAIN VOLUME OF RUNOFF, AND RECEEDING LIMB EQUALS TWICE THE RISING LIMB.



FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN 06510/203/789-1260

HYDROGRAPH $V_{OL} = \frac{1}{2} Q_P D = 3265$ AC-FT

$$D = \frac{3265 \text{ AC-FT}}{\frac{1}{2} Q_P}$$

$$D = \frac{(2)(3265 \text{ AC-FT})(43560 \text{ FT}^3/\text{AC-FT})}{(7235 \text{ CFS})(60 \text{ S/M})(60 \text{ M/HR})} = 10.9 \text{ HOURS}$$

SAY 11 HOURS & $T_P = 3.7$ HOURS

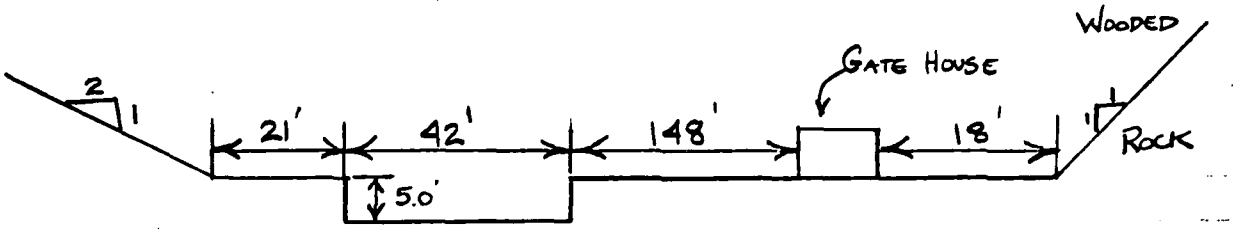
HYDROGRAPH FORMATION

$Q_P = 7235$ CFS
$T_P = 3.7$ HOURS
$D = 11.0$ HOURS

TIME HOURS	INFLOW CFS
0	0
1	1955
2	3911
3	5866
3.7	7235
4	6938
5	5947
6	4956
7	3965
8	2973
9	1982
10	991
11	0

SPILLWAY AND OVERFLOW SECTION DATA

N.T.S.



SEGMENT	ITEM	"C"	LENGTH	ELEV.
1	CONC PARAPET FENCE W/4" BAR SPACING (FENCE)	2.8	21'	255.00
2	OGEE SPILLWAY W/SIDE STEPS	3.5	42'	250.00
3	CONCRETE CREST	2.8	148'	255.00
4	CONCRETE CREST	2.8	18'	255.00

IE 250.00
IV 0.0
E 250 A 266 ACRES
E 260 A 38.6 ACRES

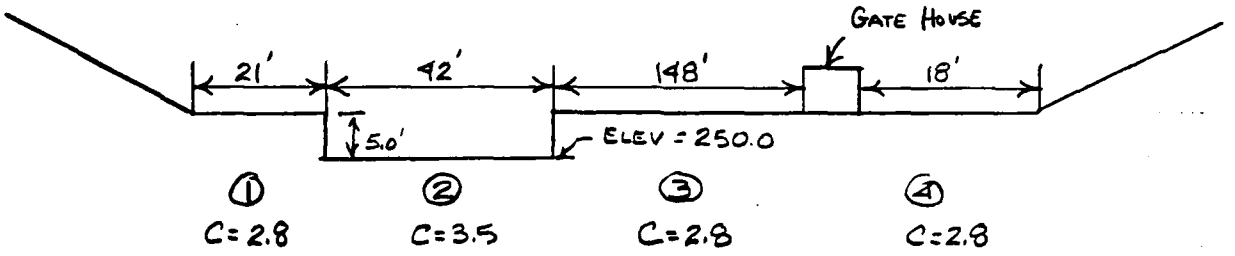
ASSUMED BREACH WIDTH = 130(.4) = 52'

PROJECT MINUCKATUCK RES DAM

FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA NEW HAVEN CONN 06510/203/789-1260

SHEET NO. 6 OF
BY RAC DATE 1-22-8
CHK'D. BY PB DATE 2-11-80

STAGE DISCHARGE DATA



ELEV	251	252	253	254	255	256	257
$Q_1 = C_1 L_1 H_1^{3/2}$						59.	166.
$Q_2 = C_2 L_2 H_2^{3/2}$	147.	416.	769.	1176.	1644.	2160.	2722.
$Q_3 = C_3 L_3 H_3^{3/2}$						914.	1172.
$Q_4 = C_4 L_4 H_4^{3/2}$						50.	143.
TOTAL CAPACITY	147	416	764	1176	1644	2683	4203

$$\frac{\text{SPILLWAY CAPACITY}}{\text{SPILLWAY TEST FLOOD}} = \frac{1644 \text{ CFS}}{3618 \text{ CFS}} = 0.45$$

MENUCKATUCK RES. DAM 1 PMF 799010 FLOOD ROUTING RAC APRIL 22, 1'

INPUT DATA: UNSUBMERGED WEIR

SEGMENT	1	DISCHARGE COEFFICIENT =	2.8	LENGTH OF WEIR =	21	ELEVATION OF WEIR =	255
SEGMENT	2	DISCHARGE COEFFICIENT =	3.5	LENGTH OF WEIR =	42	ELEVATION OF WEIR =	250
SEGMENT	3	DISCHARGE COEFFICIENT =	2.8	LENGTH OF WEIR =	148	ELEVATION OF WEIR =	255
SEGMENT	4	DISCHARGE COEFFICIENT =	2.8	LENGTH OF WEIR =	18	ELEVATION OF WEIR =	255

IE=250.0 IV= 0.0 E=250.0 A= 26.60 E=260.0 A= 38.60

HOUR	INFLOW	MASS INFLOW	WATER EL.	TAIL WATE I	OUTFLOW	MASS OUTFLOW	STORAGE(R)	STORAGE(A)
0.00	0CFS	0.00AC-F	250.00FT	250.00FT	0CFS	0.00AC-F	0.00AC-F	0.00AC-F
1.00	1,955CFS	80.78AC-F	252.18FT	0.00FT	476CFS	19.67AC-F	61.10AC-F	61.10AC-F
2.00	3,911CFS	323.18AC-F	255.90FT	0.00FT	2,560CFS	145.17AC-F	178.01AC-F	178.01AC-F
3.00	5,866CFS	727.19AC-F	257.78FT	0.00FT	5,630CFS	483.66AC-F	243.52AC-F	243.52AC-F
3.70	7,235CFS	1,106.14AC-F	258.35FT	0.00FT	6,761CFS	842.12AC-F	264.01AC-F	264.01AC-F
4.00	6,938CFS	1,281.84AC-F	258.48FT	0.00FT	7,030CFS	1,013.10AC-F	268.73AC-F	268.73AC-F
5.00	5,947CFS	1,814.28AC-F	259.08FT	0.00FT	6,207CFS	1,560.15AC-F	254.12AC-F	254.12AC-F
6.00	4,956CFS	2,264.81AC-F	257.54FT	0.00FT	5,164CFS	2,030.10AC-F	234.70AC-F	234.71AC-F
7.00	3,965CFS	2,633.45AC-F	257.00FT	0.00FT	4,213CFS	2,417.64AC-F	215.80AC-F	215.80AC-F
8.00	2,973CFS	2,920.14AC-F	256.39FT	0.00FT	3,237CFS	2,725.55AC-F	194.59AC-F	194.59AC-F
9.00	1,982CFS	3,124.90AC-F	255.68FT	0.00FT	2,294CFS	2,954.15AC-F	170.74AC-F	170.74AC-F
10.00	991CFS	3,247.75AC-F	254.67FT	0.00FT	1,485CFS	3,110.32AC-F	137.42AC-F	137.42AC-F
11.00	0CFS	3,288.70AC-F	253.00FT	0.00FT	765CFS	3,203.34AC-F	85.35AC-F	85.35AC-F

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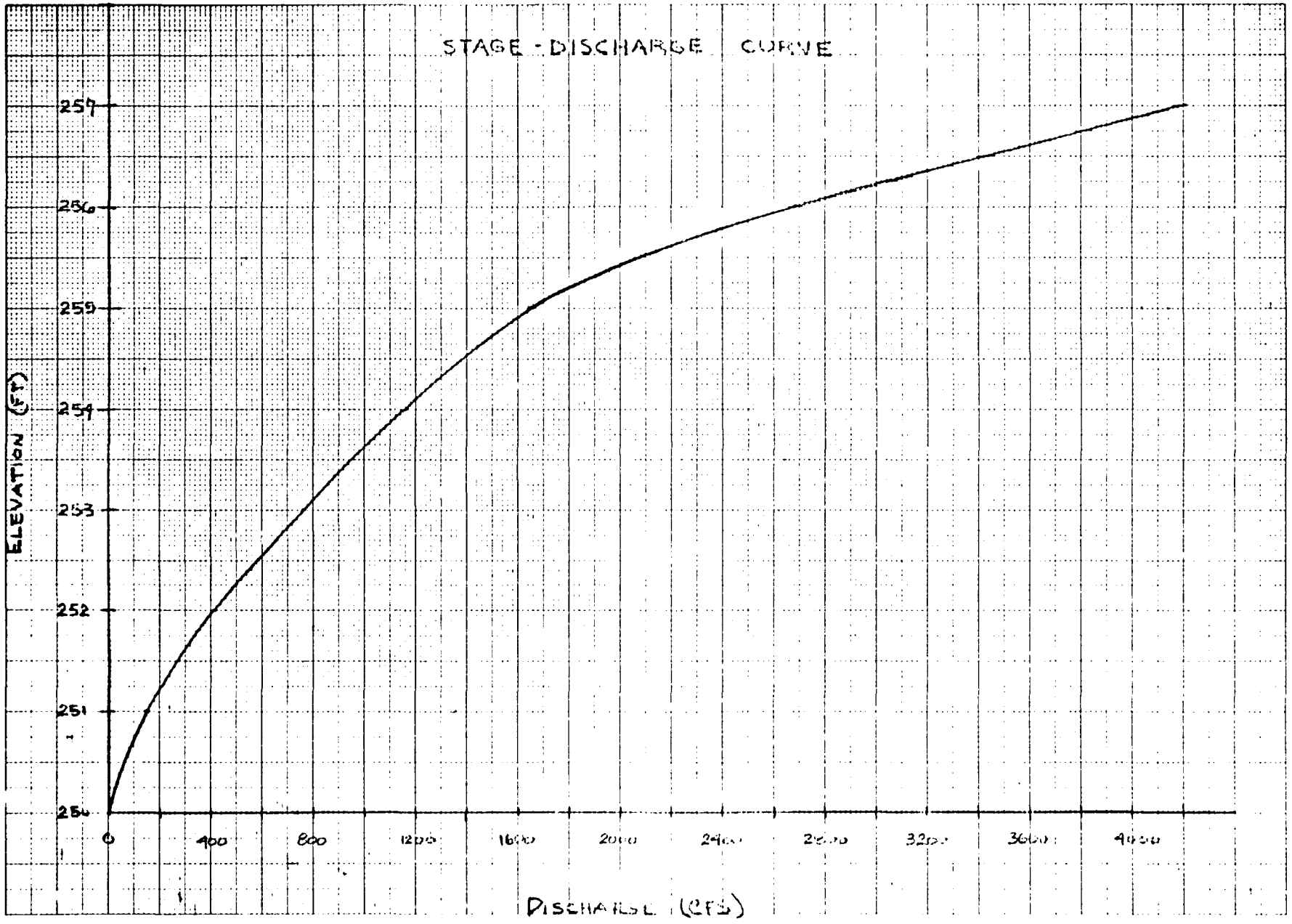


MENUCHATCHEE RES

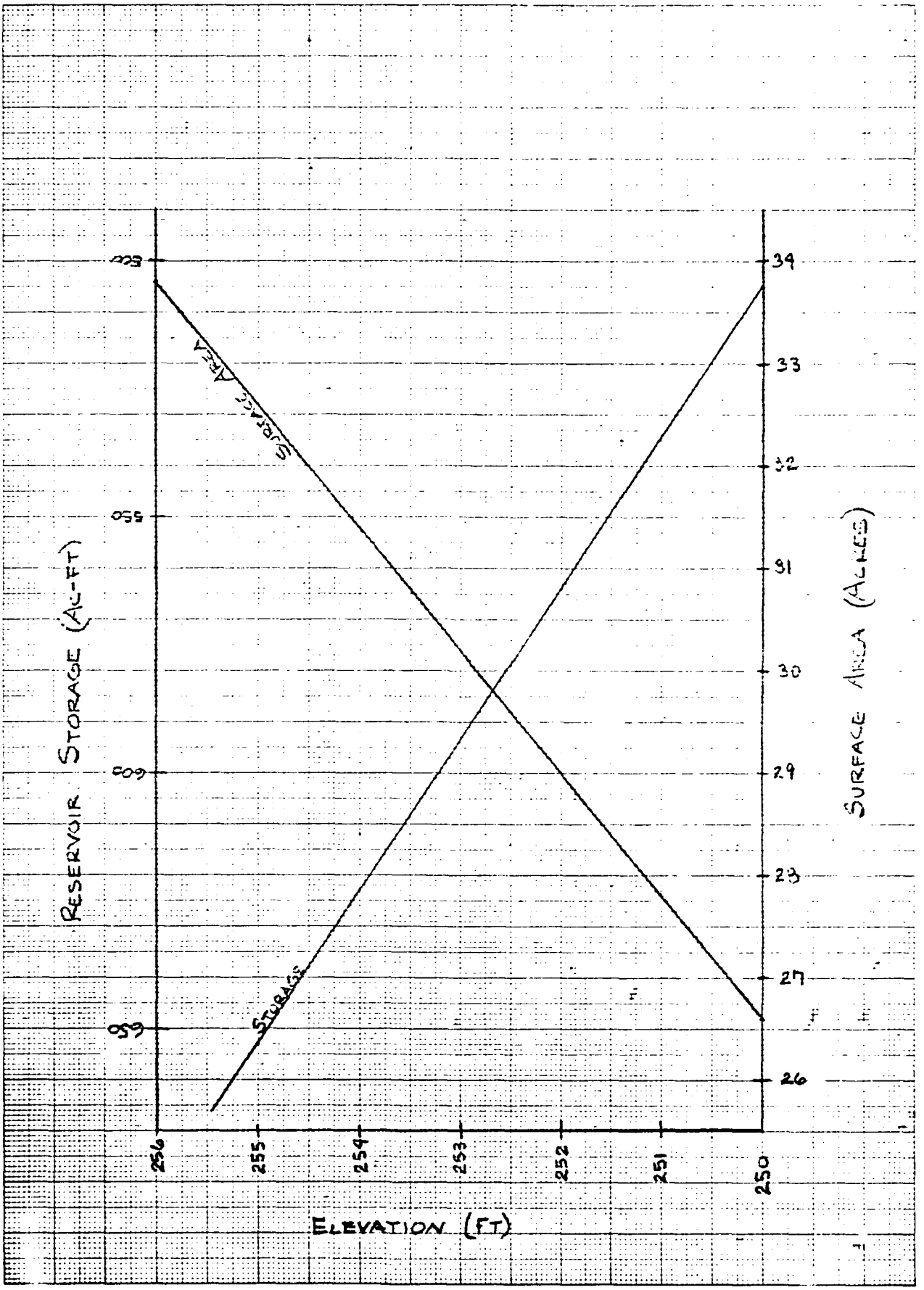
RAC 1-22-80
CK JSM 2/2/80

P.7

D-8

MENUCKATUCK RES.

RAC 1-28-80
CK JSM 2/1/80



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PROJECT 79-90-10
MENUCKATUCK DAM

FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN 06510/203/789-1260

SHEET NO. 10 OF 10
BY JGM DATE 1/23/80
CHK'D. BY PB DATE 2/11/80

SPILLWAY CHUTE CAPACITY

SECTION #1

RECTANGULAR CONC CHANNEL

$B = 18'$

$D = 4'$ SAY $N = 0.013$

$S = 3\%$

$A = B \times D = 4' \times 18' = 72\ FT^2$

$P = 18' + 4' + 4' = 26'$

$R = \frac{A}{P} = \frac{72}{26} = 2.70$

$$Q = \frac{1.49}{N} A R^{2/3} S^{1/2}$$

$$Q = \frac{1.49}{0.013} (72)(2.7)^{0.67} (0.03)^{0.5} = 2780 \text{ CFS}$$

SECTION #2

RECTANGULAR CONC CHANNEL

$B = 12'$

$D = 4'$ SAY $N = 0.013$

$S = 25\%$

$A = B \times D = 4' \times 12' = 48'$

$P = 12' + 4 + 4 = 20$

$R = \frac{A}{P} = \frac{48}{20} = 2.4$

$$Q = \frac{1.49}{N} A R^{2/3} S^{1/2}$$

$$Q = \frac{1.49}{0.013} (48)(2.4)^{0.67} (0.25)^{0.5} = 4945 \text{ CFS}$$

MENUCKATUCK DAM 79-95-1 JGM 2/2/80

FGA FLOOD WAVE ROUTING

APPROXIMATE FLOOD WAVE ROUTING BASED UPON U.S. ARMY CORPS OF ENGINEERS' "RULE OF THUMB GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS" DATED APRIL, 1978.

INITIAL STATION = 0 +0
INITIAL BASE FLOW = 1,644 CFS
INITIAL WAVE HEIGTH = 58.0 FT
ASSUMED BREACH WIDTH = 52.0 FT
INITIAL RESERVOIR STORAGE = 653 ACRE-FT
COMPUTED FLOOD WAVE PEAK FLOW = 38,594 CFS
TOTAL FLOOD WAVE PEAK FLOW = 40,238CFS

STATION 4 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.100			
-90.0 FT	250.0 FT	-15.0 FT	205.0 FT		
		N = 0.050			
-15.0 FT	205.0 FT	-10.0 FT	200.0 FT	10.0 FT	200.0 FT
15.0 FT	205.0 FT				
		N = 0.100			
15.0 FT	205.0 FT	100.0 FT	240.0 FT		

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
259.2 SF	34.2 FT	0.100	12.8 FPS	3,318CFS
654.1 SF	34.1 FT	0.050	47.5 FPS	31,124CFS
377.7 SF	46.3 FT	0.100	13.4 FPS	5,084CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
200.0 FT	22.6 FT	222.6 FT	1,291 SF	30.6 FPS	39,527 CFS	0.0500

STATION 8 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
			N = 0.100		
-100.0 FT	210.0 FT	-50.0 FT	200.0 FT	-15.0 FT	185.0 FT
			N = 0.050		
-15.0 FT	185.0 FT	-10.0 FT	180.0 FT	10.0 FT	180.0 FT
15.0 FT	185.0 FT				
			N = 0.100		
15.0 FT	185.0 FT	80.0 FT	200.0 FT	110.0 FT	210.0 FT

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
304.0 SF	43.6 FT	0.100	12.1 FPS	3,682CFS
608.0 SF	34.1 FT	0.050	45.3 FPS	27,556CFS
560.9 SF	70.1 FT	0.100	13.2 FPS	7,449CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
180.0 FT	21.1 FT	201.1 FT	1,473 SF	26.2 FPS	38,689 CFS	0.0500

STATION 13 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
			N = 0.050		
-400.0 FT	180.0 FT	-15.0 FT	175.0 FT		
			N = 0.040		
-15.0 FT	175.0 FT	-10.0 FT	170.0 FT	10.0 FT	170.0 FT
15.0 FT	175.0 FT				
			N = 0.050		
15.0 FT	175.0 FT	50.0 FT	180.0 FT	100.0 FT	190.0 FT

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
2,020.9 SF	385.0 FT	0.050	12.6 FPS	25,654CFS
357.4 SF	34.1 FT	0.040	25.1 FPS	8,988CFS
202.6 SF	49.3 FT	0.050	10.7 FPS	2,182CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
170.0 FT	12.7 FT	182.7 FT	2,581 SF	14.2 FPS	36,826 CFS	0.0200

STATION 18 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.050			
-610.0 FT	200.0 FT	-550.0 FT	180.0 FT	-450.0 FT	170.0 FT
-15.0 FT	170.0 FT				
		N = 0.040			
-15.0 FT	170.0 FT	-10.0 FT	167.0 FT	10.0 FT	167.0 FT
15.0 FT	170.0 FT				
		N = 0.050			
15.0 FT	170.0 FT	20.0 FT	180.0 FT	80.0 FT	190.0 FT

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
3,599.8 SF	511.4 FT	0.050	8.4 FPS	30,435CFS
303.2 SF	31.6 FT	0.040	12.9 FPS	3,936CFS
14.4 SF	8.5 FT	0.050	3.2 FPS	47CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
167.0 FT	10.6 FT	177.6 FT	3,917 SF	8.7 FPS	34,419 CFS	0.0060

STATION 30 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.050			
-900.0 FT	180.0 FT	-550.0 FT	170.0 FT	-15.0 FT	168.0 FT
		N = 0.040			
-15.0 FT	168.0 FT	-10.0 FT	165.0 FT	10.0 FT	165.0 FT
15.0 FT	168.0 FT				
		N = 0.050			
15.0 FT	168.0 FT	150.0 FT	170.0 FT	350.0 FT	180.0 FT
450.0 FT	190.0 FT				

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
4,410.9 SF	746.7 FT	0.050	4.0 FPS	17,661CFS
316.4 SF	31.6 FT	0.040	7.1 FPS	2,249CFS
1,317.3 SF	256.1 FT	0.050	3.6 FPS	4,809CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
165.0 FT	11.0 FT	176.0 FT	6,044 SF	4.0 FPS	24,720 CFS	0.0017

STATION 50 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.050			
-400.0 FT	170.0 FT	-50.0 FT	160.0 FT		
		N = 0.040			
-50.0 FT	160.0 FT	-10.0 FT	158.0 FT	10.0 FT	158.0 FT
		N = 0.050			
10.0 FT	158.0 FT	40.0 FT	160.0 FT	100.0 FT	170.0 FT
180.0 FT	180.0 FT				

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
1,631.5 SF	338.0 FT	0.050	5.0 FPS	8,192CFS
659.3 SF	60.0 FT	0.040	10.8 FPS	7,158CFS
599.3 SF	88.7 FT	0.050	6.2 FPS	3,763CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
158.0 FT	11.6 FT	169.6 FT	2,890 SF	6.6 FPS	19,114 CFS	0.0035

STATION 52 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.050			
-380.0 FT	170.0 FT	-150.0 FT	160.0 FT	-15.0 FT	160.0 FT
		N = 0.040			
-15.0 FT	160.0 FT	-10.0 FT	156.0 FT	10.0 FT	156.0 FT
15.0 FT	160.0 FT				
		N = 0.050			
15.0 FT	160.0 FT	50.0 FT	160.0 FT	100.0 FT	170.0 FT
170.0 FT	180.0 FT				

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
2,198.7 SF	345.6 FT	0.050	5.1 FPS	11,216CFS
374.5 SF	32.8 FT	0.040	9.4 FPS	3,527CFS
529.7 SF	81.6 FT	0.050	5.1 FPS	2,737CFS

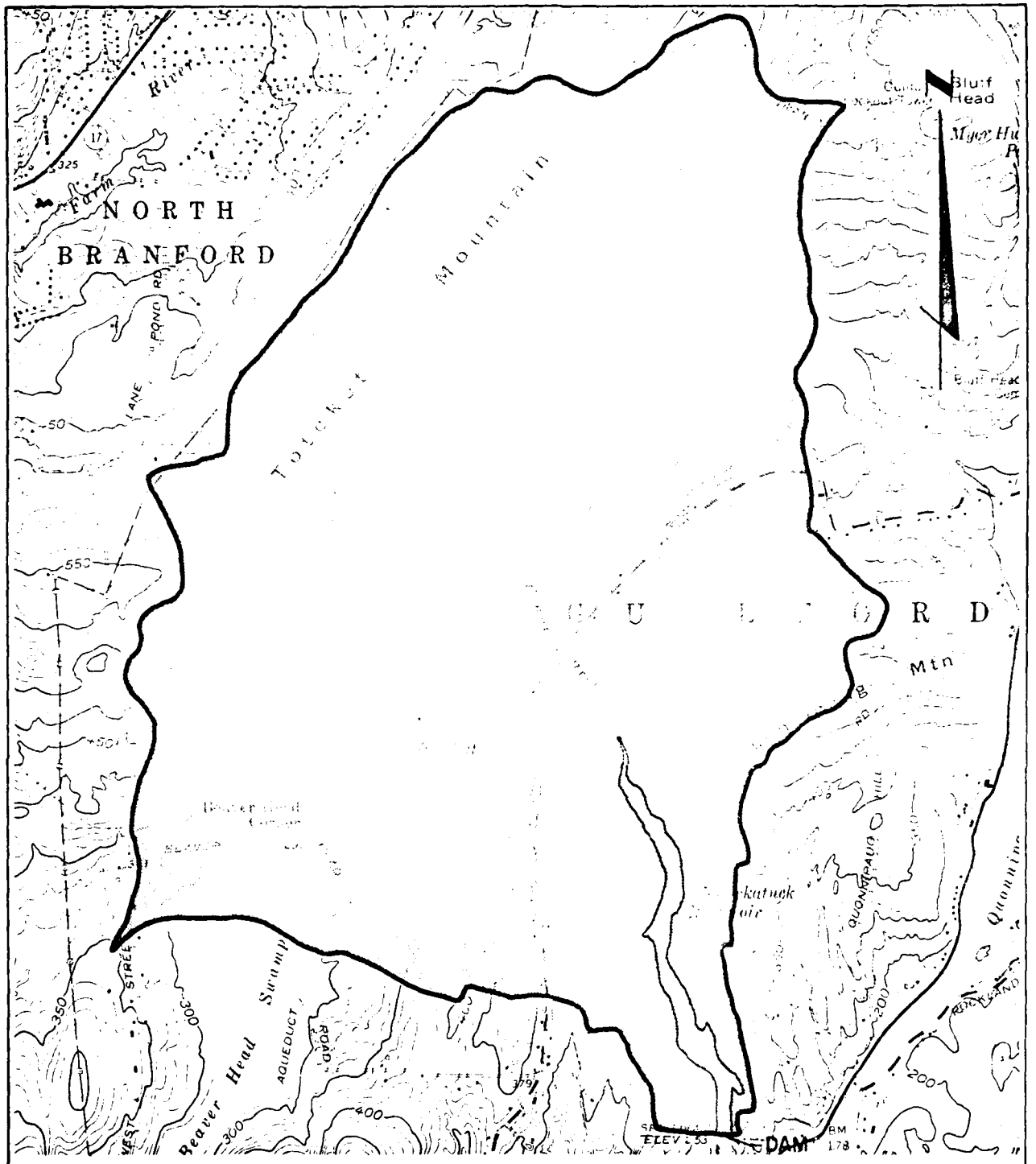
INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
156.0 FT	13.1 FT	169.1 FT	3,103 SF	5.6 FPS	17,482 CFS	0.0025

STATION 83 +0

OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.
		N = 0.050			
-200.0 FT	200.0 FT	-20.0 FT	160.0 FT		
		N = 0.040			
-20.0 FT	160.0 FT	-15.0 FT	152.0 FT	15.0 FT	152.0 FT
20.0 FT	160.0 FT				
		N = 0.050			
20.0 FT	160.0 FT	140.0 FT	160.0 FT	225.0 FT	170.0 FT
500.0 FT	180.0 FT				

AREA	WETTED PERIMETER	N	VELOCITY	FLOW
181.6 SF	41.4 FT	0.050	3.5 FPS	646CFS
639.4 SF	48.8 FT	0.040	9.2 FPS	5,899CFS
1,421.4 SF	196.9 FT	0.050	4.9 FPS	7,056CFS

INVERT	DEPTH	W. SURFACE	AREA	VELOCITY	FLOW	SLOPE
152.0 FT	16.9 FT	168.9 FT	2,242 SF	6.0 FPS	13,602 CFS	0.0020



SCALE IN FEET

2000 1000 0 2000

MENUCKATUCK RESERVOIR DAM

DRAINAGE MAP

GUILFORD, CONNECTICUT

FLAHERTY • GIAVARA ASSOCIATES, P.C.

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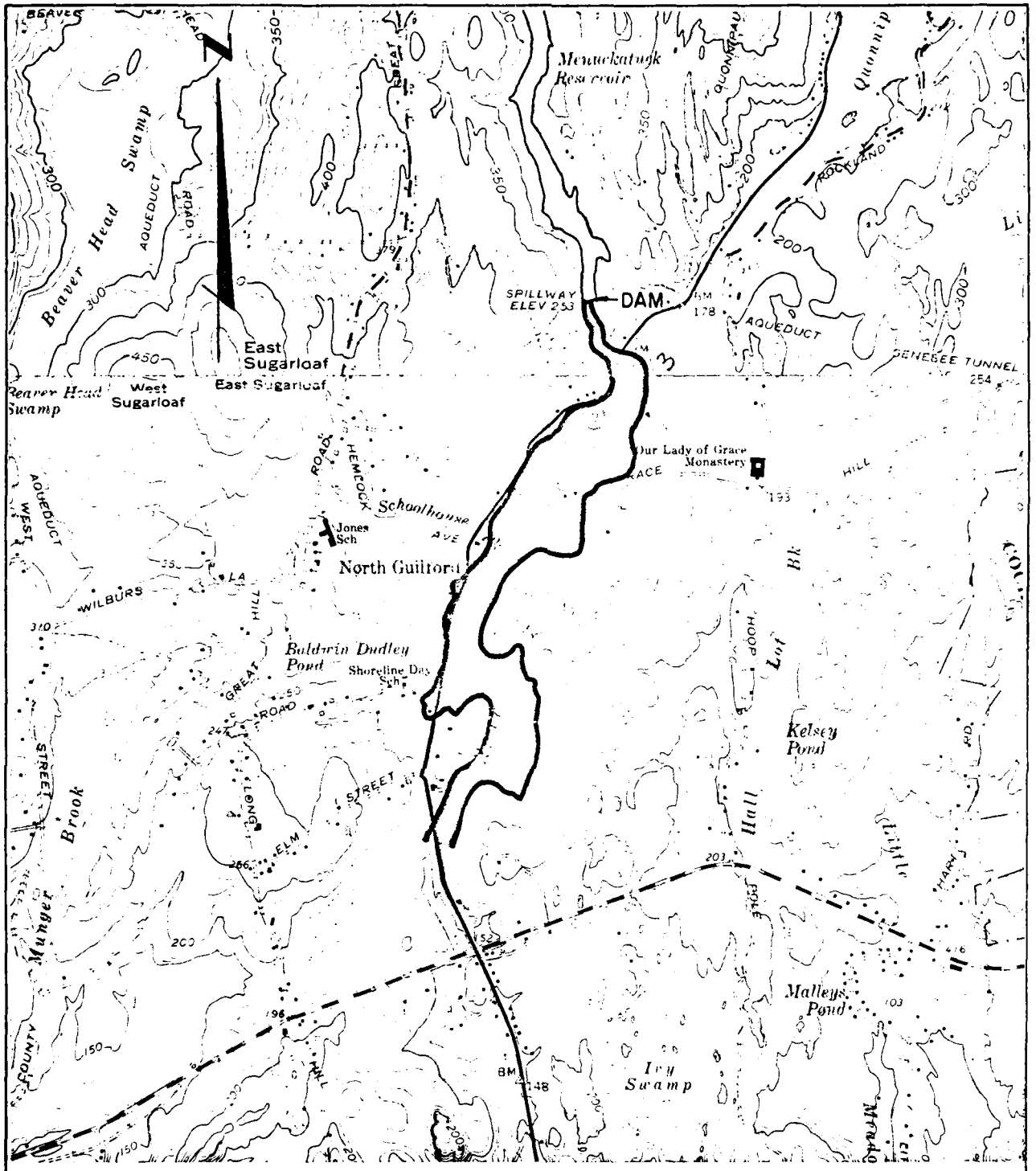

IMPACT AREA

SCALE IN FEET

2000 1000 0 2000

MENUCKATUCK RESERVOIR DAM
DAM FAILURE ANALYSIS
IMPACT AREA
GUILFORD, CONNECTICUT

FLAHERTY • GIAVARA ASSOCIATES, P.C.

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APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

NOT AVAILABLE AT THIS TIME


DATE
ILME